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CARNIVOROUS PLANT NEWSLETTER

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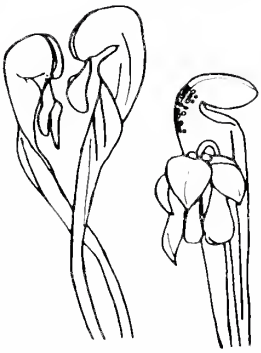

CARNIVOROUS PLANT NEWSLETTER

Official Journal of the International Carnivorous Plant Society

Volume 17, Number 1
March 1988

Front cover: *Darlingtonia californica* growing in the Mendocino bog with flowers of *Pinguicula ehlersae* visible in foreground. Photo by P. D'Amato. See article on page 15.
Rear cover: *Sarracenia leucophylla* growing in the Mendocino bog.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All correspondence regarding dues, address changes and missing issues should be sent to ICPS c/o Fullerton Arboretum, CSUF, Fullerton, CA 92634. DO NOT SEND TO THE CO-EDITORS. Checks for subscriptions and reprints should be made payable to ICPS.

All materila for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

Copy deadline for the September 1988 issue is July 1, 1988.

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CPN SEED BANK SPECIES RECEIPT AND DISTRIBUTION LIMITATIONS

by Donald Schnell

Due to recent restrictions placed on open exchange of plants or plant parts interstate in the United States and internationally, it will not be practical for the CPN Seed Bank to deal with some genera. The necessary paperwork for permits would not only involve the Seed Bank and potential recipients, but also seed donors. Also, a three party exchange with the Seed Bank as intermediary may not be allowable. In either event, we ask that donors observe the following restrictions, and that potential recipients of material from the Seed Bank understand why certain genera may have been dropped from shipment to their locality.

RECEIPT RESTRICTIONS—

The Seed Bank will not accept seeds of *Sarracenia oreophila* from either domestic or international sources.

The Seed Bank will not accept seed of other Sarracenias and any Nepenthes from **international** sources.

SEED DISPERSAL RESTRICTIONS—

The Seed Bank will not distribute seed of *S. oreophila* to any domestic or international address.

The Seed Bank will distribute seed of other Sarracenias and any Nepenthes within the United States only.

Please keep this article or a copy handy for reference as you review the Seed Bank list each issue for possible purchase or donation. Also, any additional plants added by CITES or US to appendices or other conservation restrictions will be announced in the future.

Seed Bank

Patrick Dwyer (St. Michael's Episcopal Church,
49 Killean Park, Albany, NY 12205)

To send seed: Please remove seed from the seed capsules and place it in small envelopes (preferably paper so that they dry out enough to prevent mold). Label with the origin and date of collection, including habitat if it is exotic. Fold the envelope once or twice before taping so that the seeds don't stick to the tape. After the seed is received it will be placed in smaller packets; donors will be informed of how many packets they have donated. A donation of 10-19 packets earns one free seed packet of comparable rarity, with one additional free packet for each additional 10 packets.

Do not ask to trade for seed from the bank. Everyone will have to buy all but the free packets.

To order seed: Please enclose payment. List the seeds desired and an equal number of substitutes in order of preference. If requested, Patrick will add any cultural instructions of which he is aware. Each issue of CPN will include an update of the inventory. Cost per packet: $.75. (Number of packets is listed if less than 15 are available.)

ICPS Seed Bank

February 26, 1988

Capsella bursa-pastoris (10), *Darlingtonia californica, Dionaea muscipula, Drosera aliciae* (6), *D. burkeana* (15), *D. capensis* (narrow leaf), *D. erythrorhiza, D. filiformis filiformis* (15), *D. glanduligera, D. intermedia, D. intermedia* (Carolina giant) (2), *D. pygmaea* (2), *D. rotundifolia, D. spathulata* (2), *D. stolonifera stolonifera, Polypompholyx multifida, Sarracenia alata, S. leucophylla, S. minor* (5), *S. purpurea* (6), *S. rubra wherryi* (10), *S.* x *areolata* x self (10), *S. flava* x *(alata* x *flava)* (10), *S.* x *chelsonii* (9), *S.* x *chelsonii* (9), *Utricularia lateriflora* (2), *U. pendadactyla* (3), *U. subulata* (9), *U. uliginosa* (8), *U. violacea* (10).

News & Views Item

MICHAEL HOMICK (RR #2, Tillsonburg, Ontario, CANADA, N4G 4G7) has sent his method for propagating *Nepenthes* spp. "In the spring, I first removed a terminal cutting from each vine and waited about two weeks to remove the rest. I then made additional cuttings between each leaf, being sure there was a dormant eye on each—sometimes near a flower spike there is no eye.

"The cuttings were soaked 5 to 10 minutes in a Benomyl solution and 2/3 of each leaf was removed to reduce transpiration and resultant added stress to the cutting. I then dipped the lower portion of each cutting in a rooting hormone powder, Stimroot #3, for hardwood cuttings (0.8% IBA) or Stimroot #2 for semi-hardwood cuttings (0.6% IBA).

"The cuttings were then either placed in a coarse grade vermiculite or perlite that was wetted with a weak fertilizer solution. I then placed the cuttings in their pots in a propagating case. The case is 2.5x6x2 feet high enclosed in clear plastic film. It is lighted by two eight foot fluorescent tubes. I have placed an electric tea kettle in the case connected to a thermostat with a remote sensor placed above and ten inches away from the kettle spout. Also in the case is a four inch fan to circulate air in order to prevent "hot spots." The kettle and its thermostat is set to 80° F, and connected to an electric timer so when the lights go out, the temperature drops to 65-70° F. This works fine but care must be taken not to place plants in the steam path of the kettle, and the kettle must be filled daily.

"I found that the cuttings treated with the stronger hormone powder and placed in the coarse vermiculite callused over in less than two weeks and had root formation by four weeks. The cuttings treated with the stronger hormone powder but planted in perlite were 2 to 3 weeks behind the vermiculite group. Finally, the cuttings treated with the weaker hormone powder took over eight weeks before root formation began.

"I have used this method successfully on *N. alata, N.* X *mixta, N.* X *rokko* and an unknown plant with eighty rootings from ninety cuttings."

Want Ad

CANADA ONLY PLEASE. I want to buy *Nepenthes* pitcher plants highland and lowland. Send lists with prices to: Lorne Dennison; 780 East 10th St.; North Vancouver BC; CANADA V7L 2G1.

PROPAGATION AND CULTURE OF WESTERN NORTH AMERICAN CARNIVOROUS PLANTS

Darlingtonia californica Torr., Pinguicula vulgaris L., *Utricularia spp. Drosera rotundifolia* L. and *D. anglica* Huds.

by Douglas M. Burdic, (628 Crowson Road, Ashland, Oregon 97520)

Horticulturist, Rhododendron Species Foundation
Federal Way, Washington

For centuries, carnivorous plants have fascinated people and captured the interests of all those who have studied their many unique adaptations which enabled them to lure, entrap, and digest small animals. From the tropical jungles of Southeast Asia, where *Nepenthes* species grow as vines beneath the forest canopy, to the rocky slopes of the Pacific coastal range, where *Darlingtonia* flourish in the spring-fed serpentine bogs, carnivorous plants survive in extremely fragile habitats that are all too often being destroyed by either land reclamation operations or massive wholesale collecting. In the past, the predominant method of producing carnivorous plants for the market can only best be described as the "search and destroy technique." Some of our Southwestern U.S. species, such as *Sarracenia oreophila* and *S. alabamensis* have already succumbed to these pressures and are now only found as relics in a few scattered botanical sanctuaries. This same fate could very possibly befall our western populations of *Darlingtonia californica* (even though it is now semi-protected under both the Endangered Species Act of 1973 and the CITES agreement), unless habitat destruction and all field collecting is stopped and substituted with competitively priced nursery-grown stock. In support of this letter goal, I offer this paper as a tool that will demonstrate time-proven propagation/culture regimes for *Darlingtonia* and the eight other species of carnivorous plants that are found in our western region.

Darlingtonia californica Torr. (California Pitcher Plant) Brief Description:

Darlingtonia is a monotypic genus that is endemic to the Pacific coastal bogs and mountain slopes from western Oregon to northern California. The plant has erect, tubular pitcher leaves which can reach a height of 90 cm., but are usually smaller. The apex of the leaves terminate in a globose hood, with a fishtail appendage projecting out from the pitcher entrance. This interesting morphology gives the plant an overall reptilian (specifically, cobra-like) appearance to many who observe it for the first time.

General culture:

1. Exposure: 50% shade during summer months.
2. Optimum temperatures: Growing season: 26.7° C (80° F) Day, 20° C (68° F) Night
   Winter: 6.7° C (44° F) Day, 1.1° C (34° F) Night
3. Humidity: 75-90%
4. Fertilization: No fertilization should be applied.

Darlingtonia is an acid-loving plant, as are most carnivorous plants, and will thrive in a variety of well drained mixes, providing that the pH does not exceed 4.5-5.0 I have had the best results by using a mixture of Canadian sphagnum peat moss and washed silica sand in a ratio of 2:1. Other mixes that work easily as well are: Live sphagnum moss alone, perlite/peatmoss 1:1, pure vermiculite, course granite gravel, or various combinations of these ingredients. Besides using a medium with a low pH, the grower must be extremely careful about the quality of water that is being used while growing these glycophytic (sensitive to

high salt concentrations) plants. Irrigation water used on *Darlingtonia,* and for that matter, any carnivorous plant, should have a measured total solid content of less than 50ppm. (equivalent to 100 micromhos electrical conductivity)[4] Tap water is almost always unacceptable for this purpose because of high salt levels as well as other impurities. There are several ways of securing relatively pure water for carnivorous plant cultivation: collecting rain water, reverse osmosis apparatus, and distillation are the most commonly used methods. In cultivating *Darlingtonia,* water temperature is also an important factor for success. In their natural habitat, even though the ambient air temperature surrounding their leaves may exceed 30° C (85° F), their roots are constantly kept at approximately 11° C (52° F) by slow moving natural waters. In cultivation, *Darlingtonia* roots begin to die off when rhizophere temperatures reach 18.3° C (65° F), and unless high humidity levels are maintained and root temperatures decreased, the plant will perish.[2] A grower can simulate this natural cooling effect of *Darlingtonia* by either manually pouring cool water through the containers at least once a day during the hot summer months, or by installing a timer-controlled pump connected to drip irrigation tubing. A simple method of maintaining a cool water supply without refrigeration is by sinking the storage tank into the soil and protecting it from solar radiation. Containers recommended for *Darlingtonia* are unsalted clay pots, or fiber pots. Both of these types allow for more air exchange and aid in keeping the roots at a lower temperature via an evaporative cooling effect.[4] Fiber pots are short lived, but are used for a reason that will be explained below under propagation.

Darlingtonia pitcher (L) and flower (R).
Photos by J.A. Mazrimas.

NOTE: This remarkable phenomenon can be clearly seen in a movie shown on NATURE on PBS called "Sexual Encounters of the Floral Kind"; about pollination syndromes. The waterlily flower is, of course, not carnivorous in the traditional sense in that it does not digest and absorb nutrition from the victim, as far as we know. By **Larry Mellichamp.**

Darlingtonia must have a dormancy period of between 3 to 5 months if they are expected to survive more than one or two growing seasons. During this period, my plants are cultivated in a cool house where temperatures are kept just above freezing at night, and average 6.7° C (44° F) in the day. During this period, watering should be reduced, and a monthly spray with Benlate will be beneficial in guarding against fungus attacks.

Propagation

Seed:

In nature, flowering time is usually from April to August. Pollination should be done about 3 to 5 days following anthesis when pollen matures. The seed should mature in approximately 10 weeks and should then be stratified at 4.4° C (40° F) for 3 months. When ready, the seed can be sown on moist sphagnum moss or peat moss, and germinated in a closed propagation case or greenhouse to maintain a high humidity. Bottom heat of 23° C (73° F) will aid in germination, but should not be used once seedlings have developed their new root system for reasons stated earlier. *Darlingtonia* plants undergo a juvenility phase during their first years' growth and sometimes into the second season, but gradually typical adult leaves will form from the center of the rosetted seedlings. To produce a saleable plant using the seed method will usually take around 3 years.

Rhizome cuttings

In a container situation, a mature *Darlingtonia* plant will send out several rhizomes which will encirle the pot several times if they arise from an older plant. These rhizomes will form buds at their apex, eventually forming new individual plants which can then be severed and repotted. In using fiber pots, these new plants will grow through the container walls, form roots, and can be removed much easier than they could be if they were grown in more restrictive clay pots. If a grower had several large stock plants, this method could produce a substantial number of new plants each year with a minimum of effort.

A second method of propagation using the rhizome is to divide it into one-inch segments, treat with a mild Benomyl fungicide solution and placed in flats of live sphagnum moss.[3] If these are kept humid, new plants should be formed in 3-6 months.

Pinguicula vulgaris L. (Butterwort) *Brief Description:*

Of the 48 known species of butterworts in the world, only one inhabits the bogs of our area, *Pinguicula vulgaris.* It's range extends around the world in the boreal region and as far south as the Great Lakes, and northern California. In our area, these small rosette-forming plants usually measure 5-9 cm (2-3½") across, and are very easily overlooked unless one happens by them during their flowering season which is from June to August. The leaves feel greasy to the touch because of glandular secretions used in trapping and digesting small insects. This plant is predominantly found in rocky seeps in the surrounding soil of serpentine bogs, often in close association with *Darlingtonia.*

General culture:

1. Exposure: 50% shade during summer months
2. Optimum temperatures: Growing season: 26.7° C (80° F) Day, 20° C (68° F) Night
   Winter: 6.7° C (44° F) Day, 1.1° C (34° F) Night
3. Humidity: Maximum humidity.
4. Fertilization: No fertilizer should be applied.

Whereas most carnivorous plants prefer a very acid medium, this plant is said to grow equally well in acid, neutral or alkaline soils. I grow my plants in a mixture of Canadian sphagnum peat moss/washed silica sand (1:1). These plants require a cool root system also, but they tend to develop root rot when constantly wet, so a fast draining medium is recommended. These plants cannot tolerate the intensity of full sun. I shade them at least partially during middle to late summer to aid in cooling and to encourage winter bud

formation. Dormancy can be a problem in this species of *Pinguicula* because of their characteristic formations of winter hibernacula. The hibernacula are very susceptible to a variety of fungus problems, and to avoid this, some growers suggest that they be removed from their containers, dusted with sulfur and subjected to a 4 month period of refrigeration. In my greenhouse, the hibernacula are left in their pots, sprayed with a dilute fungicide, and kept much drier than normal until they resume growth in the spring.

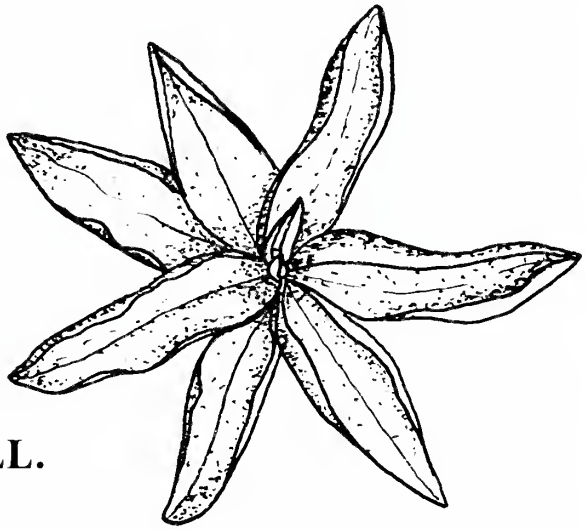
Propagation:

Seed Production:

Pollination of this species of *Pinguicula* can be accomplished with a steady hand and a small brush. The beautiful zygomorphic (asymmetrical) flowers have partly fused petals and are morphologically designed to discourage self-pollination. The anterior stigma lobe must be first lifted with a brush to expose the anthers, or one can cut away the petals which greatly simplifies the operation. When ripe, the seed should be stratified for 4 months at 2.0°C (35°F) after which they can be sown on a bed of granulated peat moss, sprayed with a fungicide, and kept moist. Germination should take place in 6 to 8 weeks. *Pinguicula* species are intolerant of root disturbance, and should never be transplanted during their growing season.

Gemmae

This is by far the fastest, most efficient method of propagation for this particular species, both in its natural habitat and in cultivation. At the end of the growing season, these small reproductive structures will form at the base of the hibernacula. At the end of the dormancy period, these can be easily removed and replanted separately, and will shortly form their own root system.



P. macroceras. Drawing by Ron Fleming.

Cephalotus LABILL.

C. follicularis *LABILL.* W. AU

Leaf cuttings:

I have never had any degree of success with this method of propagation for this species, nor has anyone else I've corresponded with, but it works very well for several other species of *Pinguicula* so it will be mentioned here to encourage experimentation. Leaves should be removed in late spring and an attempt should be made to include part of the leaf base with it. The leaf should be sprayed or dusted with a fungicide and then placed on a bed of live sphagnum moss which can then be covered. The problem with this method of propagation in the past has been in preventing degeneration of the tissue long enough for plantlets to be formed.

Utricularia vulgaris L., *U. gibba* L., *U. fibrosa* Walt., *U. minor* L., *U. intermedia* Hayne. (The Bladderworts) *Brief description:*

Of the 250 species of *Utricularia,* these five are found in our western region. These aquatics and semi-terrestrials are rootless, free-floating carnivorous plants that probably possess the most sophisticated trapping mechanism of any of the carnivorous plants known to man. Since the culture and propagation of our western species is essentially similar, they will be combined into one category for explanatory purposes. The plants can range in sizes from 1 inch to 3 meters in length. They consist of rootless, branching, free-floating stems, which bear more delicate lateral branchlets arising along their length. These smaller branchlets in turn, give rise to very small bladders that are capable of catching small aquatic prey. Basically, there is an equal water pressure gradient from outside to inside the trap lining and when small animals disturb one of the trigger hairs located at the entrance, an electrical potential causes the negative pressure area inside the bladder to suddenly become flooded with an inrush of water containing the intruder. At the instant that this is occurring, the bladder door closes and seals off the trap preventing any chance of escape. As with the butterworts, these plants would probably be overlooked by most people, except when they are flowering. Their small yellow flowers can be seen rising above their aquatic environment on tall stalks from May to September.

General culture:

1. Exposure: 75% shading all year.
2. Optimum temperatures: Growing season: 26.7° C (80° F) Day, 20° C (68° F) Night
   Winter: 6.7° C (44° F) Day, 1.1° C (34° F) Night
3. Fertilization: No fertilizer should be applied.

All of our *Utricularia* species are aquatic with the exceptions of *U. gibba* and *U. fibrosa* which can also be grown in a sphagnum slurry (sphagnum water 1:1). The simplest way to grow aquatic *Utricularias* is by filling a large wading pool with 5 cm. of a peat sand mix 2:1, and then adding pure water. This should be allowed to age for at least one week before the *Utricularia* plants are introduced. Ideally, the pH should be at about 4.6 for optimum growth and should be checked as a final precaution. If the water is still too alkaline, cedar chips, sphagnum moss, or dilute sulfuric acid (only by a qualified person) can be used to lower the pH to an acceptable level. The temperature regimes mentioned earlier for *Darlingtonia* and *Pinguicula* are also acceptable for this genus.

Propagation:

The simplest method is to simply break the stems into smaller sections in the spring. I don't recommend seed propagation except for the obligate terrestrial *Utricularias* in the eastern region.

Drosera rotundifolia L. and *D. anglica* Huds. (Sundews) *Brief description:*

The genus *Drosera* includes over 90 species worldwide. The genus is represented in the western region by two species, *Drosera rotundifolia* (Round Leaved Sundew) and by *D. anglica* (English Sundew). Both of these plants are found in sphagnum bogs located throughout the northwestern states, north ot Alaska and east to Newfoundland, and in Eurasia. These rosetted plants usually don't exceed 8 cm. (3") in diameter, but even for their small size, they are seldom overlooked due to the spectacular color display they present which results from the glistening mucilage secretions on their leaves. This secretion arises from tentacles that are used to ensnare and digest small insects and at times these tentacles along with the entire leaf blade will bend totally around the captured prey to prevent escape. The flowers of both species are usually white and are borne from June to September.

General culture:

1. Exposure: 25% shade during summer months.
2. Optimum temperatures: Growing season: 26.7° C (80° F) Day, 20° C (68° F) Night
   Winter: 6.7° C (44° F) Day, 1.1° C (34° F) Night
3. Humidity: 75% humidity.
4. Fertilization: No fertilizer should be applied.

These *Drosera* species will grow in the same mixes used for *Darlingtonia* and *Pinguicula*. I don't recommend using pure live sphagnum moss since it has a tendency to over-grow the small plants in a greenhouse environment. *Drosera* should be watered only by a capillary system, not by overhead irrigation. Care should also be taken to keep the leaves from being constantly wet as this will encourage disease problems. I usually keep my plants in the section of the greenhouse farthest from the humidification system.

Both species form winter hibernacula and it is during these winter months that most plants are lost to the grower in cultivation, usually due to incomplete winter bud formation, or from over-watering. Losses can be minimized by removing the plants from the greenhouse environment in the fall to encourage healthy winter bud formation, and by treating with a dilute fungicide. Dormancy temperatures and conditions are identical to those discussed for *Pinguicula vulgaris.*

Propagation:

Seed:

Both of these species self-pollinate with very little assistance and seed is produced profusely. After the seed has ripened it should be stratified for at least three months at 3° C (37° F). The seed should be sown on granulated peat moss and kept moist. Germination should occur in 4 to 6 weeks.

Leaf cuttings:

This method is recommended over seed propagation. Young, healthy leaves should be removed in late spring through early summer and placed on damp peat moss. If kept humid, new plantlets should form on the leaves in about one month. I have also had success simply by floating the severed leaves on the surface of a container filled with distilled water. When the plantlets develop individual root systems, they can be transplanted.

Tissue-Culture of Carnivorous Plants;

Only limited formation is presently available on this subject, but due to the recent advances made in that field, we are now able to propagate many species of carnivorous plants using these new techniques. I am not involved in this aspect of carnivorous plant propagation as of yet, but Mr. Bill Carroll has suggested the following media be used as a standard.[1] He has had success using variations of this recipe on both *Darlingtonia californica,* using a surface-sterile seedpod, and on certain *Pinguicula* species using the shoot meristem. He also suggests that when making a liter of this media, one should take 200ml. increments and vary the amount of hormones added starting with .1mg/liter and not to exceed 1.5mg/liter initially. (See Table 1)

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3. Cheers, Gordon. 1983. *Carnivorous Plants.* Carnivor-Insectivor Plants, Victoria. Australia. pg. 78-79.
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Table 1.

Media Ingredients for Pinguicula

		Milligrams/liter
$Ca(NO_3)_2$	Calcium Nitrate	1000
NH_4NO_3	Ammonium Nitrate	300
KH_2PO_4	Potassium Phosphate	250
$MgSO_4$	Magnesium Sulfate	250
$MnSO_4$	Manganese Sulfate	10
Fe Chelate	Iron Chelate	20
Thiamine		10
Inositol		100
Sucrose		20,000
Agar		12,000

Plant hormones for shoot multiplication are Kinetin or 2iP in a range of 0.5 mg/liter of solution. Auxins for rooting were IBA or NAA in a range of 0.1 to 1.0 mg/liter.

The media is brought to a boil while stirring constantly, dispensed into test tubes or other containers, and steam sterilized for fifteen minutes at fifteen pounds of pressure (120° C. or 250° F.).[1]

Conclusion

For many years, knowledge concerning the culture, propagation and conservation of carnivorous plants was practically unobtainable, but due to the efforts of serious individuals and the International Carnivorous Plant Society and other groups around the world, we now have an internationally organized network of growers who freely exchange information and ideas concerning all aspects of these frequently endangered species. Even as this paper is being written, huge stands of carnivorous plants in this country are being bulldozed in land development projects. In many instances, by the time all the paperwork required in classifying a species as endangered is finished...so is the plant. Hopefully, this article has inspired some readers to put into practice the ideas and techniques stressed in its content and to pursue further knowledge on the subject of carnivorous plants in general.

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1. Lloyd, Francis E. 1976. *The Carnivorous Plants.* Dover: New York.
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A NEW *DROSERA* FROM THE SECTION ARACHNOPUS?

by M. Studnicka
(Ostravska 675, 460 01 Liberec, Czechoslovakia)

In Czechoslovakia, 2 types of *Drosera adelae* are grown. The first one is characterized by red flowers, the second one by whitish flowers (see photos). The leaf rosettes are very similar. Both of these types easily could be taken for a coloured form of the same species. Surprisingly, in spite of this fact, the significant differences can be found in the flower organs.

The red type has flattened, lobed stigmata; the whitish type is characterized by clubshaped stigmata. The bifurcation of the styles of the first order is to be found in a different place. The styles of the red type are erect, the styles of the whitish type are pressed down to the ovary (see fig. 1 and 2). Unlike the whitish type, the red type is proterogynic (the stigma is active a few days before the pollen is poured out of the stamens). The pollen of the red type is by a quarter smaller than the pollen of the whitish one (see tab. 1). The red type is allogamic, while the whitish one is autogamic.

Tab. 1 Magnitude of pollen grains (in millimetres) of different types of *Drosera adelae* and the related species.

	D. adelae red type	*D. adelae* whitish type	*D. prolifera*	*D. schizandra*
the largest grain	0.038	0.048	0.040	0.044
the smallest grain	0.026	0.036	0.036	0.040
average of 10 pieces	0.030	0.043	0.039	0.043

It might be presumed that the red type is a hybrid between *D. adelae* and some closely related species (*D. prolifera* or *D. schizandra*; *D. indica* is not taken into account because it is an evolutionarily separated species (see Laverack 1979). But such a hypothesis is not supported by a comparison of the pistil's shape in these species (fig. 2).

The different generative organs of these types also hardly could generate suddenly in consequence of one mutation (for example polyploidisation). These complicated differences might arise most probably by gradual, considerably long-termed evolution of separated populations. Both these types of *D. adelae* indeed present closely related but phyiogenetically different taxa. Probably they are not artificially produced cultivars, although they were identified in a culture.

Which of them is, however, the "real" *D. adelae?* This question is answered neither in Diels (1906) nor in Flora of Australia (Marchant et George 1982). Perhaps some of our Australian colleagues might thoroughly study the nomenclatoric type deposited in the herbarium in Melbourne?

See **FIGURES 1 and 2** on page 14.

Color types of *Drosera adelae*

Drosera adelae - whitish type

D. adelae - red type

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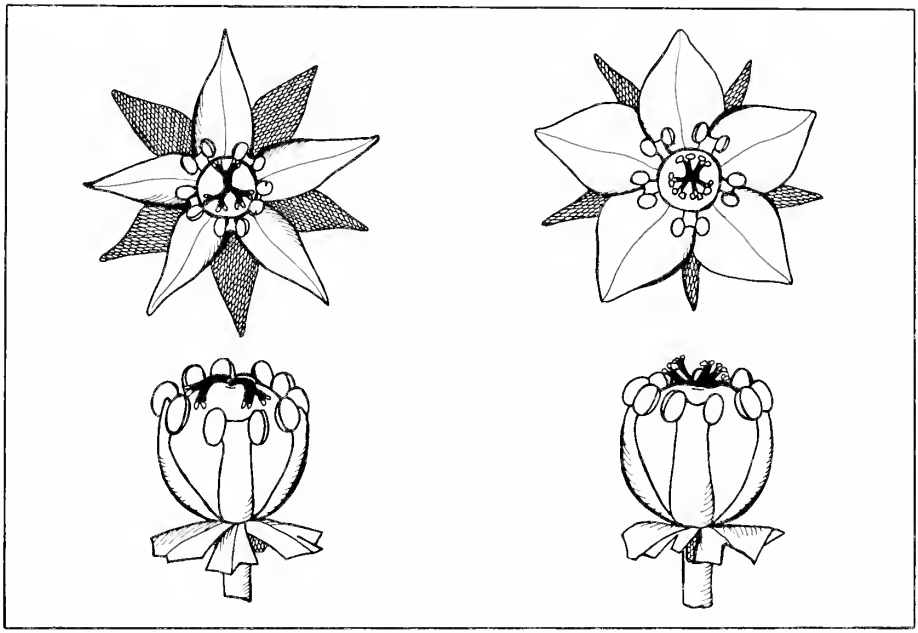


Fig. 1 Flowers and sexual organs of *Drosera adelae* - whitish type (left) and *D. adelae* - red type (right).

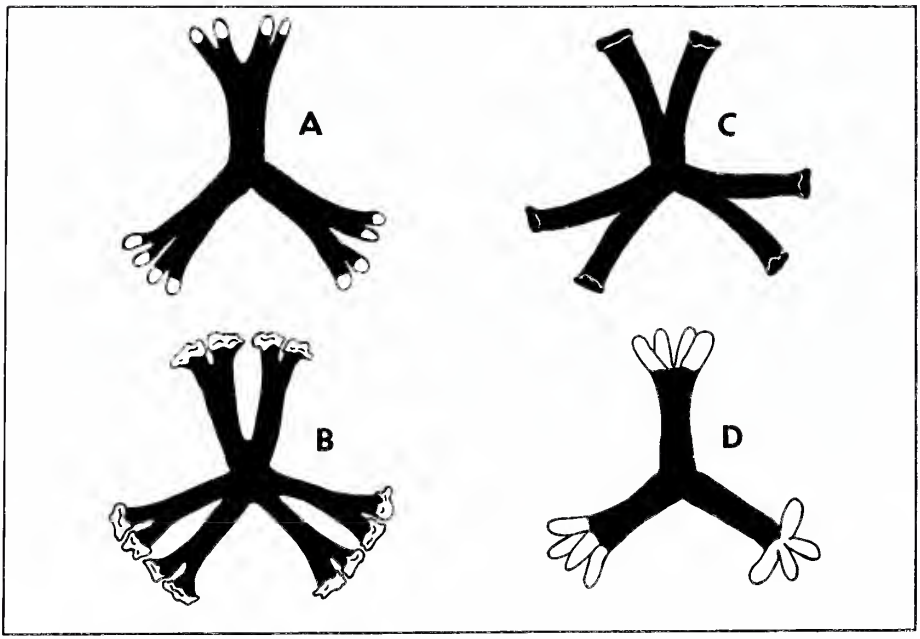


Fig. 2 Styles and stigmata of *Drosera adelae- whitish type (A), D. adelae* - red type (B), *D. prolifera* (C) and *D. schizandra* (D). (Drawings by Regina Studnickova.)

A Field Trip to Mendocino

By Peter D'Amato
P.O. Box 1372, Guerneville, CA 95446

Our cars pulled up in a cloud of dust along side a narrow road in the middle of a flat pine forest. There were ten of us, all CP growers, and as we ambled out of the cars, tugged on our boots, and checked our cameras for the last time, we were awed at the silence of the woods around us. A few hawks circled overhead.

"This way," someone said.

We followed him down a sandy trail. We were struck by the desolate look of the forest around us. The widely spaced trees were no taller than ourselves, twisted and contorted, tortured by the environment they lived in. The soil was hard and crusty from the seasonal summer drought; a sandy mix that looked like peat and cement. Lichens covered the branches of the dwarf pines, and there were rhododendrons scattered here and there and a few huckleberries. We looked like a march of giant Paul Bunyons, our heads poking above the forest canopy, able to see a mile in any direction.

"Over here," said Joe Mazrimas, and we left the main trail and pushed through the branches and came to a clearing. The ground was suddenly oozing. He pointed to a bright green mound. *"Sphagnum,"* he said.

"And *Drosera rotundifolia,"* said Mike Morris, crouching. "Hundreds of them!" The plants were a striking form of the common sundew: compact, deep maroon, and thick leaved. They grew flat on a dry crust of black peat, their roots penetrating deep to the moisture below. A few feet away the peat was visibly wet and an abrupt mound of yellow-green sphagnum rose like a spongy dome over the barren soil. We huddled around with our magnifying lenses. Although it was the same round-leaved species, in the moss the sundew formed the more familiar long green petioles poking two inches into the air, the wide blades thick with red tentacles. A flower stalk branched to five points above the rosette.

Chuck Powell led us a few dozen feet to a shallow pool of acidic water. The small pond was only a few inches deep, and only tufts of sphagnum grew along the embankment of naked black peat. "Look at these *'rotundifolia',"* he said. "Aquatic." Scattered rosettes of the sundew, some over five inches across and deep red, floated upon the surface of the pond. Chuck dipped his hand into the pool and lifted the spoked leaves of a plant. "Practically rootless," he said. "They just float on the algae."

We heard a cry from behind a clump of tall sedge grass. Several people were huddled over something exciting and Allen Krever was taking photographs. It was a blaze of *Drosera binata multifida,* spidery and glistening, a clump almost two feet across.

"Look at this," called Geoff Wong. His finger pointed to an embankment where the puffed serpentine heads of *Darlingtonia* poked from a green waterfall of sphagnum. There were dozens of them, and scores of bright maroon seedlings matted the ground like writhing snakes.

There was a lot more to see, and soon our group was moving from this mound of sphagnum to that bed of peat, cameras clicking, and boots oozing into the muck.

We found clumps of hip high *Sarracenia,* and between the *rubra* and *minor* the bright lavender flowers of *Pinguicula esseriana* yawned into the air. Just across from a couple of venus flytraps next to a slow moving stream grew a few bold looking *Drosera anglica. Darlingtonia* shaded some flat glittering rosettes of *Drosera aliciae.* Scores of *Drosera capensis* grew a stone's throw from a small clump of *Heliamphora.*

Where were we, South Africa? The east coast of Australia? Or was this the Green Swamp of Venezuela?

Fig. 1 *Drosera rotundifolia* growing aquatically.

Fig. 2 *D. binata multifida* with mostly "T" type leaves.

ALL PHOTOS BY AUTHOR

Fig. 3 *D. rotundifolia* on drier peat substrate.

Fig. 4 *Darlingtonia & Sarracenia* together in Sphagnum.

Fig. 5 *D. rotundifolia* on black peat.

Fig. 6 *D. capensis* in flower growing in sedge.

Fig. 7 *Darlingtonia* seedlings.

Fig. 8 *Sarracenia* growing in Mendocino bog.

The ten of us had agreed the previous August during the San Francisco Plant and Flower Show to meet two months later and almost two hundred miles north, in the small coastal lumber town of Fort Bragg, Mendocino County, California. This thirty mile strip of northern California coast, from the Navarro River in the south to Ten Mile River in the north, has attracted geologists and botanists the world over for decades. This is where the famed geological terraces are, and the mysterious pygmy forests of Mendocino.

Geologists now recognize this ancient coastline to be a prehistoric wonder, a monument to the changing level of the sea from glacial age to glacial age. Here, in the form of terraces going inland and uphill, are the remains of five Pleistocene beaches, each several hundred feet wide and about a hundred feet higher in elevation than the last. Each ancient beach or terrace was formed hundreds of thousands of years apart in some cases, and pushed even further above the sea level by the plate tectonics of the San Andreas fault, so that the first terrace above the present beach goes back almost 100,000 years, while the uppermost terrace, now some 600 feet above the ocean swells, is estimated to be around a million years old.

In our present era, each terrace plays host to its own ecosystem, from the dunes of the current beach to prairie grassland (first terrace) to redwood forest (second terrace) to Bishop Pine (third) and Douglas Fir (fourth). It is the uppermost, or fifth terrace, that most interests us. Here, on this million year old ridge some 700 feet above the sea, lie the ancient sand dunes that are now the habitat of a natural bonsai forest.

After countless millennia of winter rains, the soil here has been leached to become one of the poorest in the world. With a pH of about 3.0, the top layer of soil is an extreme podzol only a few dozen centimeters deep, underlain by an impenetrable layer of iron-cemented hardpan. Of the few plants adapted to this harsh environment, many have become naturally dwarfed, such as the Mendocino cypress, *Cupressus pygmaea,* and Bolander's Pine, *Pinus contorta ssp. bolanderi.* A fifty year old tree can be just 2½ feet tall with a trunk only a few centimeters thick.

It is in these pygmy forests that a few sphagnum bogs have been formed. Winter rains saturate the forest, forming pools of acid water from November until May. During the summer drought the ground dries out except in a few locations where underground pools and streams are locked in by the impervious ironstone. If the underground water supply is sufficient, the soil surface remains moist and sphagnum moss takes hold, forming small patchy peat bogs amid the dry pygmy forest, bogs that seem to shift over the decades with the amount of winter rainfall.

And where sphagnum grows, so does *Drosera rotundifolia.* This is the southernmost coastal location of sphagnum in the west. Bogs become more common hundreds of miles to the north, in the famed locations of *Darlingtonia.*

Joe Mazrimas hunted out these rare bogs of Mendocino County back in the late 1960s. During the 70s, he, Larry Logoteta and Ray Triplett chose one small section of an isolated bog in the southern extreme of the pygmy forests for experimental plant studies. Plant competition was negligible as the extensive mats of sphagnum played played host only to the common *D. rotundifolia,* which often didn't even colonize the moss in some locations. So they scattered seed and planted greenhouse specimens of various CP from around the world in this one bog, and the results were what the ten of us CP growers saw in October, 1987: a small botanical garden of world carnivorous plants.

Soil conditions aside, it is the mediterranean climate of Mendocino County that make the bogs so hospitable to a wide variety of plants. From late fall to late spring, the coast receives almost 40 inches of rain, with temperatures 38 to 65F (4 to 18C) and rare frost. In the summer, the drought is relieved by heavy coastal fog that mists the pygmy forests to the point of dripping, with temperatures 50° to 80° F (10° to 27° C).

Although many species of CP have been tried, it is interesting to note the survival record. One species introduced by seed has become most obviously naturalized, that being *Darlingtonia.* The pygmy forest bogs are more similar to the species' Oregon coast habitats than to the mountains of California. *Darlingtonia* grow thick, with seedling colonies spreading down slowly moving streams in sphagnum. A surprisingly prolific plant is *Drosera capensis,* often dying back to its roots after winter frosts only to reappear with a vengeance in spring. *Drosera capensis* can grow as a small, compact, bright red plant on a sunbathed mount of peat, to a large and green stalked plant in shallow, shaded pools of acidic water.

The various sarracenias have thrived, forming thick colonies along sphagnum stream beds, mostly proliferating by branching rhizomes. Although abundant flowering was evident, no seed was found in the few capsules examined, and there is no evidence of seedling growth as there is with *Darlingtonia.* The plants grow beautifully, though, with many robust species and hybrids.

Joe Mazrimas reports disappointment with *Dionaea.* Although thousands of seeds have been scattered over the years, only a half dozen or so have survived to an attractive maturity. Joe believes rodents may be devouring the bulblike rootstock of the flytraps. They survive best when hidden in sphagnum.

There is a small and handsome colony of *D. aliciae* apparently spreading through seed production, and a few *D. anglica* have survived the transition from their colder mountain habitats. Another failure is apparently *D. filiformis* and its forms. None could be found despite all the seed that had been scattered. A couple of highland *Nepenthes* plants also have not survived. Forms of *Drosera binata* have spread into large clumps but would need different clones nearby for seed production. The same is true for several Mexican pings found in the bog, although some may be producing viable seed. Their colorful flowers poke vigorously from the moss and everyone is surprised they haven't been lost to the giant and aptly named banana slug known to the area.

Two clumps of *Heliamphora heterodoxa* have recently been introduced, and are expected to do well since they enjoy a *Darlingtonia*-like habitat. Time will tell, and only a severe frost may endanger them.

On that weekend in October everyone seemed to get into the act. In stage two of the experimental plantings, seeds of largely winter-growing Droseras were scattered upon the dry peat mounds, sure to be wet come the winter rains. In a few years plants such as *D. macrantha, peltata, pauciflora* and *trinervia* may be growing in the pygmy forest as well.

But there was more to do in Mendocino than just bogging.

Bob Standley of Noyo River Laboratories, the tissue culture lab, showed off his own pet project at the Mendocino Botanical Gardens. Bob is a popular orchid and rhododendron grower in the area, with a large selection of CP in his Fort Bragg greenhouses as well. It looks like he may have convinced the directors of the attractive Botanical Gardens to turn their neglected lily pond into one of the largest outdoor CP bogs in cultivation. Everyone was enthusiastic over the 50x30 foot area as being ideal to grow a wide assortment of CP in a mild outdoor climate. There was a lot of work to be done, from draining to clearing to preparing, but already Bay Area growers were lining up donations of plants to put in the bog. In a couple of years the CP bog may be the hit of the Gardens.

Bob next took us to a rhododendron nursery owned by a friend. In a man-made pond on the property, giant *Utricularia* had made an appearance "out of nowhere." Joe Mazrimas guessed the species to be *U. vulgaris (macrorhiza).* The bladders turned from green to red to black, and the meter long stems were just beginning to form their winter turions.

See **MENDOCINO** on page 21

New CP Cultivar Received in 1987

by James T. Robinson
1201 N. Race Ave., Arlington Hts., IL 60004

The following cultivar has been received during 1987 for publication in CPN:
Nepenthes (Florida g.) 'Nina Dodd'

Originated by Cliff Dodd, 2225 S. Atlantic Ave., Daytona Beach, FL 32018; received Dec. 31, 1987. Florida grex resulted from crossing *Nepenthes bicalcarata* x *Nepenthes* x *dyeriana*. 'Nina Dodd' is the sole survivor of eight germinated seeds resulting from the pollination of about 50 flowers in 1984. The general appearance of the cultivar is about mid-way between that of its parents. The shape of the pitcher resembles that of the seed parent. Stems are dark green and slightly tomentose. Leaves are petiolate, 45 cm. long, 12 cm. wide, dark green above and lighter below; tendrils are light green. Lower pitchers are 10 cm. high, 5 cm. wide, with two frilled wings 20mm. wide. Pitchers are heavily mottled red and green. The peristome is light green striped with reddish purple. The lid is about 2.5 cm. long, 2 cm. wide, light green above and mottled red below. At the junction of lid and peristome is an upright, unbranched spur. Upper pitchers have not yet formed nor has the cultivar flowered.

Vegetative propagations of this cultivar should be on display at the Atlanta Botanic Gardens in 1988.

Photo by Cliff Dodd

Nepenthes (Florida g.) 'Nina Dodd'

Book Review

Pietropaolo, James and Patricia Pietropaolo, 1986. Carnivorous Plants of the World. Timber Press, Portland, Oregon. 206 p. $25.00

Although known as diverse botanical entities for hundreds of years, serious interest in growing carnivorous plants as horticultural specimens extends to the middle of the 19th Century when explorers returned to the Old World with specimens of strange pitcher plants found in the various parts of the world: the United States, Venezuela, Borneo, and Australia. The "Golden Age" of carnivorous plants began about 1873, when Charles Darwin published *Insectivorous Plants.* He studied the trapping mechanisms of eight different types, including Venus' flytrap, sundews, butterworts, and bladderworts. Our southeastern United States' native pitcher plants *(Sarracenia* spp.) had not yet proved to be carnivorous, and thus they were not included in his book. Only after Joseph H. Mellichamp, M.D., of Bluffton, South Carolina published his observations in 1875 on the "attractive" nature of the sweet secretions and the "digestive" ability of the liquid inside the tubular leaves of the hooded pitcher plant *(Sarracenia minor)* did the notion become apparent that these plants might be carnivorous also (catching mostly ants, beetles, and moths). In the second edition (1893) of Darwin's book there was a brief mention of pitcher plants.

For botanists and others wishing to learn more about the behavior and the peculiarities of these intriguing plants by growing them, this modern book written by two long-time carnivorous plant growers is a most useful volume. Readers may be surprised to learn that there are over 15 genera and more than 550 species of carnivorous plants located throughout the world. This diversity is divided among many phyletic lines, from moderately-advanced to highly-advanced families. There is even a carnivorous monocot (a bromeliad, *Brocchinia reducta),* though it is not considered in the present book. Despite the diversity, carnivorous plants do seem to have in common the requirement for moist-to-wet substrates, and they are generally found in nutrient-poor habitats.

See **BOOK REVIEW** on page 25

MENDOCINO continued from page 19

The group saw other bogs in the pygmy forest area. Around one pond in a transition zone between redwoods and pygmies, a type of aquatic sphagnum grew, dying back to sheet moss as the pond shrank during summer. Surprisingly no *D. rotundifolia* or *Utricularia* grew there, and we debated back and forth as to why.

In another bog we found acidic pools with a more delicate *Utricularia* growing in it, with bright yellow flowers over the surface, probably *U. gibba.* We saw other bogs that were lush and wet in winter, with sphagnum three feet deep in areas, that became dry and dormant in the summer months. *Drosera rotundifolia* apparently survived drought years through seed.

That evening the group gathered in one of the hotel rooms and was entertained by the experience of veteran CP growers Joe Mazrimas and Larry Logoteta. Legends of the CP world were remembered, and plans for a possible northern California CP club were discussed.

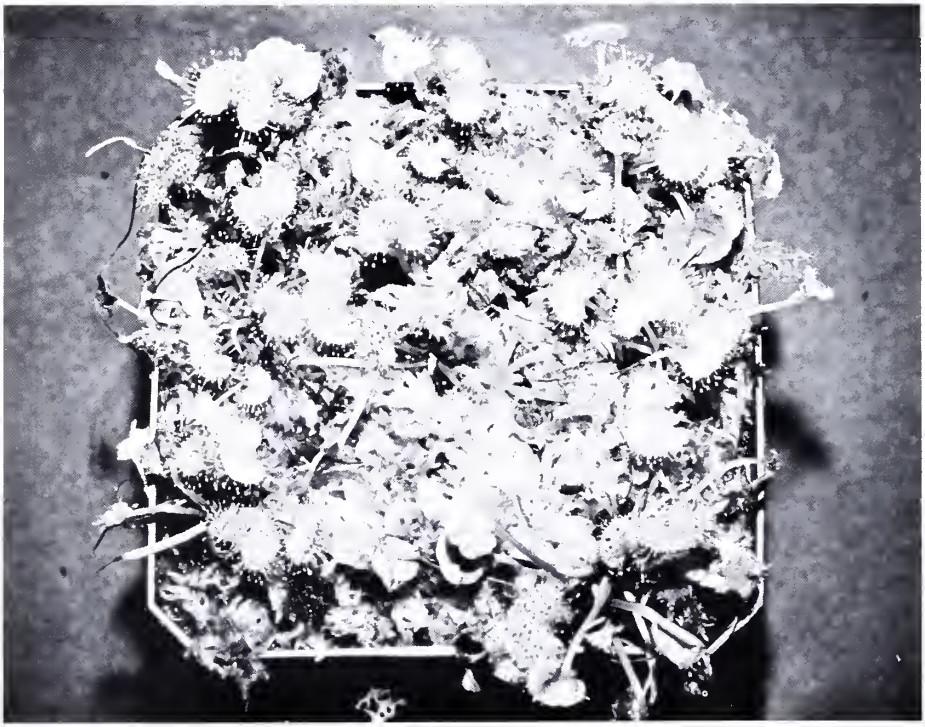
The following day we ended our field trip with an afternoon at Bob Standley's greenhouses and lab. Although specializing in orchid and begonia culture, Bob passed around vials of *Heliamphora* and *Nepenthes* for all to see. We were awed by his flow tables of *Pinguicula* that grew to the size of dinner plates, and of the giant *N. truncata* and *spathulata* hanging from the rafters under glass.

It was a pleasant way to end a busy weekend, a field trip that seemed to take us all the way around the world.

On the Care and (Not) Feeding of *D. Adelae, Prolifera* and *Schizandra*

By Roger Hoelter
955 Barcelona Dr.
Santa Barbara, CA 93105

I am relatively new to the keeping of carnivorous plants, (especially when compared to the editors of this newsletter). I have kept plants for about 5 years now, growing some fairly successfully and turning others into low grade organic compost. While I am new to carnivorous plants, I have kept, bred, and occasionally given talks on tropical fish for over 25 years. I would like to preface this article with some thoughts which I have frequently used to begin a talk on breeding tropical fish. The methods which I am about to explain work for me and my specific growing conditions. Since your growing conditions will not be exactly the same as mine, my methods may or may not work well for you. Since we can never exactly duplicate the growing environment other people use, each of us has to determine the methods which work best for us under our own specific conditions. The methods we learn from others can only be used as starting points in finding the methods which will work best for us. Don't be discouraged when you have failures. Finding the methods which work best for you takes trial and error; inevitably leading to some failures (sometimes for the beginner many failures). Only by learning from these failures can each of us find the methods we can use successfully. As a specific example of this, many people grow a large variety of sundews quite successfully in sand-peat mixtures. For me, under my growing conditions, using the types of sand and peat available in this locality, sand-peat mixtures seem to work very poorly.

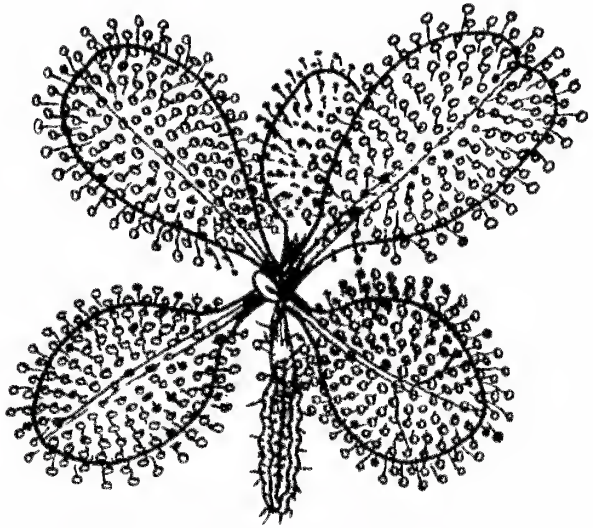


Drosera prolifera growing in sphagnum. Photo by J.A. Mazrimas.

D. adelae, prolifera, and *schizandra* come from the same general area in Australia, and seem to require similar care to survive in cultivation. I have been keeping *D. adelae* successfully for about three years and *D. prolifera* and *D. schizandra* for about a year and one half. Over these time spans the *D. adelae* and *D. prolifera* have each produced over a hundred small plants and the *D. schizandra* about twenty. Although I live in an area that has quite mild growing conditions out of doors almost all year around, these three species are grown indoors under lights. Growing indoors allows the easy maintenance of three of the conditons that these species seem to need for survival in cultivation—low light level, high humidity and mild temperatures.

The potting mixture used is a 50/50 mix of milled Canadian sphagnum peat moss and vermiculite. The adelae and schizandra both have relatively long, thick roots. They are planted with as many of the roots as possible running horizontally, just below the surface of the potting mix. Quite frequently many new plants will develop along these surface roots. In fact, the *D. adelae* which is the source of all the plants I presently have, died a few weeks after I purchased it, but from the surface roots came a half a dozen small plants. The majority of the new plants that the *D. adelae* and *schizandra* have produced have been by this method. Large, bottom leaves which were in contact with the potting medium have also occasionally been the source of new plants. Both species should be able to be reproduced by either leaf cuttings or root cuttings, but I have never tried either. The *D. adelae* produce enough small plants on their own that I never have to try other methods, and the *D. schizandra* never seem quite robust enough that I want to remove any leaves or roots.

The *D. prolifera* is potted in the same mix. However, this species doesn't seem to produce the long, thick roots like the *D. adelae* and *schizandra* or produce new plants from the roots. Therefore, the roots are placed down into the potting medium rather than along the surface. New plants are produced quite easily from this species. *D. prolifera* flowers readily and is almost continually in bloom. The tip of almost every flower spike will produce a new plantlet. If the plantlet is removed from the flower-spike, another will form at the farthest remaining node on the spike. Additionally, older leaves which droop and make contact with the soil frequently produce several new plants.



Drosera schizandra drawing by Ron Fleming

All three species are planted in rather deep pots (3 to 4 inches depth). They are watered by letting them stand in water continuously. The water used is purified by reverse osmosis. It contains less than 17 ppm of calcium and magnesium. The plants should **never** be fertilized. Although many species of carnivorous plants seem to benefit from the application of dilute fertilizer (the tuberous *Drosera* do not grow well without it), to these species the application of fertilizer is lethal. This was learned the hard way – by applying fertilizer to robust, healthy plants and watching them disintegrate in less than a week.

These plants require fairly low light levels. I obtained my *D. prolifera* and *schizandra* from Bruce Pierson in Australia. He told me that he kept his plants in his greenhouse **under** the benches. My plants are grown under a bank of three 40 watt fluorescent lights. The lights are on 16 hours per day, year around. The plants are six to nine inches from the lights. The *D. adelae* seem to prefer the brightest light and is placed in the center of the area directly under the lights. The *D. prolifera* takes slightly lower light levels. They are positioned aorund the edges of the lighted area. The *D. schizandra* do best at the lowest light levels. Not only are they placed at the edges of the lighted area, they are also placed so they are shaded by other plants (e.g. *Nepenthes).*

In addition to low light levels, high humidity is a requirement. The requirements seem to be related to the required light level with the *D. adelae* needing the lowest humidity and the *D. schizandra* the highest. The *D. adelae* will grow and multiply at fairly low levels of humidity, but it no longer looks like a sundew as all the tentacles dry up. For best growth, all three species are kept in a tray of water which is enclosed on all four sides by plastic sheeting. Additionally, a clear plastic dome is placed over the *D. prolifera* and *schizandra*, keeping the humidity around the plants at nearly 100%. The very high humidity provided by the plastic dome seems to be a necessity to grow *D. schizandra* successfully. For all but the largest plants, clear plastic drinking glasses (available in a wide variety of sizes from restaurant supply houses) will do the job very well.

If you are able to provide these species with the growing conditions they require, you will be well rewarded. These species are among the most beautiful of the *Drosera* and are worth the slight extra time and work it takes to grow them well.

Errata

Bruce Lee Bednar
12731 SW 14th Street, Miami, Fla. 33183

In the issue of CPN Vol. 16 #3, in "Naming the Hybrids," on page 70 the last sentence of the top paragraph reads-"N. x rokko, N. x balmy koto and N. x masamiae *are all N. maxima crosses"!*

It should read- *"are all N. thorelii x N. maxima crosses."*
Then in the references just under that mistake you have *T. Kusakabe,* and it of course should be *I. Kusakabe.* CPN regrets these errors. (Ed.)

Want Ad

Kenneth Bruyninckx (O.L. Vrouwestr. 58, 2070 Ekeren, BELGIUM) (WB) seeds or plants of the following: *Heliamphora sp., Nepenthes rajah,* South American epiphytic *Utricularia* sp..

Their book is a noteworthy addition to the popular literature. While it does not contain detailed botanical descriptions, it does have very good descriptions of the habitats, habits, and trapping mechanisms of all genera. It is clearly written and logically organized, giving explicit details on the cultural requirements of each group of carnivorous plants. Especially lucid are explanations of the formation of scientific plant names, the techniques of hybridization and asexual reproduction, and the concept of cultivars. I am surprised, however, at their statement that there is no registration authority for cultivars of carnivorous plants when the *Carnivorous Plant Newsletter* (the quarterly publication of the International Carnivorous Plant Society) has been such since 1979. [For information write *CPN*, Fullerton Arboretum, California State University at Fullerton, 92634].

The numerous line drawings accompanying each chapter are the best I have seen, and in many instances they illustrate the "how to" aspects described in the text. The book also contains exhaustive lists which are useful for checking plant names and indicating which plants are commercially available. It is not, however, a manual for the identification of species and hybrids. There is a useful chapter on how one should begin a collection with considerations of lighting, potting media, watering, and meeting dormancy requirements. Making sense out of the challenging tuberous *Droseras* from Australia, for instance, is one of the strengths of the book.

I was somewhat disappointed with the 16 pages of color plates. While they do provide excellent close-ups of the structures of several species that are rarely shown, the colors of ten appear dull and muted.

Nevertheless, this is the most comprehensive guide to culture, propagation, and hybridization available, and will be an indispensable reference for those attempting to grow these beautiful and interesting plants. I would especially recommend the *Sarracenia* pitcher plants to teachers as comparatively easy-to-maintain (just keep them wet and in full sun) educational specimens that illustrate the principles of variation and hybridization (including hybrid vigor) among distinct species.—T. Lawrence Mellichamp, Department of Biology, University of North Carolina at Charlotte, Charlotte, North Carolina 98223. (Reprinted from Castanea via author)

COMING IN JUNE, 1988

HELIAMPHORA ISSUE

- A Practical Method for Cultivation of *Heliamphora* spps.
- On the Cultivation of the South American Pitcher plant, *Heliamphora neblinae.*

Also

- CITIES, TRAFFIC, USFW-Are You Caught in the Alphabet Soup?
- Changes in Regulations Effecting International Trade in CP
- CP in Mirconesia

Call for papers

CPN would like to begin to feature growers of CP. Please send a clear photo of yourself preferably with your CP along with a brief biographical sketch telling how you got started in CP, ones you grow, travels, etc.

Keep those articles coming.

The 1988 List of CP Books

***Not* available through *CPN*.** Order directly from publisher, your local bookshop or C.P. Nursery.

* = Books intended primarily for children.
☐ = Books out-of-print

1. *Animals & Plants that Trap by Phillip Goldstein. Holiday, 1974; Holiday House, Inc.; 18 E. 53rd St.; New York NY 10022. $5.95.
2. Carnivorous Plants by Gordon Cheers. Globe Press, Melbourne. World Insectivorous Plants; P.O. Box 70513; Marietta GA 30007; USA. $7.00
3. Carnivorous Plants by Francis E. Lloyd. Peter Smith; 6 Lexington Ave., Magnolia MA 01930; USA. 1942 ed. Paper $7.95 from Dover Publications; 31 E. 2nd St.; Mineola NY 11501. Or: World Insectivorous Plants; P.O. Box 70513; Marietta GA 30007; USA. $8.00
4. Carnivorous Plants by Randall Schwartz. Avon Books, 1975; 959 Eighth Ave.; New York NY 10019; USA. Soft cover $1.25.
5. Carnivorous Plants by Adrian Slack. MIT Press, 1979; 28 Carleton St.; Cambridge MA 02142; USA. 1980 ed. $28.00. 1984 paper $12.50. Or: World Insectivorous Plants; P.O. Box 70513; Marietta GA; USA. Paperback $12.50.

☐ 6. Carnivorous Plants by John F. Waters. Franklin Watt, Inc., 1974; 845 Third Ave.; New York NY 10022; USA. $4.90.

7. *Carnivorous Plants by Cynthia Overbeck. Lerner Publications, 1982; 241 First Ave.; Minneapolis MN 55401; USA. $12.95.
8. Carnivorous Plants of Australia. Vol. 1. by Allen Lowrie. West Australia Univ. Press, 1986; Nedlands WA 6009; AUSTRALIA. Or: International Specialized Books; 5602 NE Hassalo St.; Portland OR 97213; USA. Paperback $32.50; hardback $45.00. Plus $2.25 UPS.
9. Carnivorous Plants of the World by J. & P. Pietropaolo. Timber, 1986. Peter Pauls Nurseries; Canandaigua NY 14424; USA. $30.30.
10. Common Marsh, Underwater & Floating Leaved Plants of the United States & Canada by Neil Hotchkiss. 1972. World Insectivorous Plants; P.O. Box 70513; Marietta GA 30007; USA. Paperback $8.00.
11. CP of the US & Canada by D.E. Schnell. John F. Blair, Publisher. 1976 1406 Plaza Dr., SW; Winston-Salem NC 27103. 1976 ed. $9.50 + shipping.

☐ 12. Cultivating Carnivorous Plants by Allen Swenson. Doubleday & Co., 1977; Garden City NY 11535; USA. $7.95.

13. *Insect-Eating Plants by L. & G. Poole, T.Y. Crowell, 1963; 666 Fifth Ave.; New York NY 10016; USA. $4.50.
14. Insect-Eating Plants and How to Grow Them by Adrian Slack. 1986. Marston Exotics; Hurst Lodge; Martock; Somerset; ENGLAND; TA12 6JU. $20.00.
15. Insectivorous Plants by Charles Darwin. AMS Press, 1893; 56 E. 13th St.; New York NY 10003; USA; Vol. 12, 1972. $42.50.
16. *Nepenthes* of Mt. Kinabalu (in English) by S. Kurata. Sabah National Park. World Insectivorous Plants; P.O. Box 70513; Marietta GA 30007 USA. $10.00.
17. Pitcher Plants by Carol Lerner. William Morrow & Co.; New York. $11.00.
18. Pitcher Plants of Peninsular Malaysia & Singapore by Roger G. Shivas. Maruzen Asia Pte. Ltd.; 51 Aver Rajah Crescent #07-09; Singapore 0531. $10.50.

☐ 19. Plants of Prey in Australia by Rica Erickson. Univ. of W.A. Press, 1986.

20. *Plants That Eat Animals by J.H. Prince. Lodestar Bks.; 2 Park Ave.; New York NY 10016; USA; 1979 ed. $8.95.

See **BOOKS** on page 27

Carnivorous Plants of Australia: Volume One

By Allen Lowrie. XXV, 200pp, 133 colour plates and 51 full-page drawings. University of Western Australia Press, Nedlands, W. AUSTRALIA, 1987.

Paperback A25.00, hardback A35.00
Review by Martin Cheek.

The first of 3 volumes, this deals exclusively with the tuberous sundews of W. Australia. Comparison with the recent account by N. Marchant and Alex George in Flora Australia (F.A.) *8* (1982) are invidious but inevitable: 3 more species are detailed here and 12 additional subspecies, bringing the new total to 46 taxa, including 31 species. At last we have botanical names for the plants we have been growing under cultivar names for so long e.g. *Drosera* 'Gold Leaf' is now recognizable as *D. bulbosa* ssp. *major* and D. 'Red Edge Form' as *D. erythrorhiza* ssp *squamosa*. All those very diverse rosetted plants received as *D. erythrorhiza* or *D. bulbosa* are now recognized as the distinct species and subspecies (ignored or overlooked in F.A.) that they always seemed: whereas 4 rosetted sorts are recognized in F.A., 12 are described here.

Each plant is very clearly described in a page of text followed by a few interesting paragraphs on its most outstanding features and how to tell it apart from its closest relatives. There follows a full plate of the most superb drawings, far better, more beautiful and comprehensive than the F.A., a distribution map (needless to say, ten times better than F.A.) and outstanding colour plates showing, separately, habit and habitat and a close-up of the flowers.

The opening pages contain keys to the species, illustrations of *Drosera* structure, notes on the techniques used in studying and photographing, and probably more on the biology of this fascinating group than has ever been published in one place before. The author obviously knows his plants very well and has had the added benefit of assistance from such stalwarts as Steve Rose and Phil Mann. He is not a professional botanist, being a businessman (swimming pools and gold mining) by trade, but this book suffers little from the deficiency.

The publishers are to be congratulated on the excellent publication and, above all, on the realistic price of this marvellous book which follows (but surpasses) the format of such as Sainsbury's Field Guide to *Dryandra* (1985).

Speaking as a plant taxonomist, I would much rather N. Marchant had validated the new species he is credited with before publication of this book, but Allen Lowrie can hardly be faulted for this. Minor errors occur in the keys and glossary and in the statement that 'Australian tuberous *Drosera* in cultivation in the Northern hemisphere break dormancy at about the same time as do plants in Southern hemisphere.': they are in fact 6 months out of phase once established. But we must not be over critical, lest the author loses the enthusiasm he will surely need to complete the 2nd and 3rd volumes. If they are not ambiguous, authoritative and as well written and illustrated as this one, we will be very well served.

This book is essential reading as the major reference work on Australian tuberous sundews: buy it.

BOOKS continued from page 26

21. *Plants that Eat Insects; A Look at Carnivorous Plants by Anabel Dean. Lerner Publications. 1977; 241 First Ave.; Minneapolis MN 55401; USA. $5.95.
22. *Secrets of the Venus' Fly Trap by Jerome Wexler. Dodd, Mead & Co., 1981; 79 Madison Ave.; New York NY 10016; USA. $9.95. Or: World Insectivorous Plants; P.O. Box 70513; Marietta GA 30007; USA. $9.00.
23. World of Carnivorous Plants by J. & P. Pietropaolo. R.J. Stoneridge, 1974. Peter Pauls Nurseries; Canandaigua YN 14424; USA. $8.95.

Literature Review

Barker, Nancy G. and G. Bruce Williamson, 1988. Effects of a winter fire on *Sarracenia alata* and *S. psittacina.* Amer. J. Bot. 75:138-143.

Prescribed winter burning of a Louisiana savanna containing these two species showed an increase in foliage the following growth year. There was an increase of leaves in *S. alata* and of ground cover in *S. psittacina.* There was also greater seedling activity of *S. alata.* The gain of foliage of *S. alata* in burned plots was less than the loss in unburned plots, just the opposite of the cover with *S. psittacina.* **Summer** burns did not have a positive effect. There was little change in flowering rate the first year after winter burn. DES.

CASPER, S. Jost. 1987. On *Pinguicula lignicola,* an epiphytic heterophyllic member of the Lentibulariaceae in Cuba. Pl. Syst. Evol. 155:349-354.

This short paper reviews the morphology and some of the growth habit and habitat of this epiphytic butterwort. The plant grows on trunks and limbs of *Pinus* spp. along streams, measures about 2.0 cm. across when mature, and has blue flowers. The species exhibits heterophylly as well—that is, seasonal variation in leaf shape and variation between mature and immature plant leaves. Special root modifications allow the epiphytic habit. This species is compared to a similar one from Espanola with lighter flowers and lesser heterophylly. The article includes good photos and line drawings. DES

Govus, Thomas E. 1987. The occurence of *Sarracenia oreophila* (Kearney) Wherry in the blue ridge province of southwestern North Carolina. Castanea 52:310-311.

Two populations of *S. oreophila* have been located in Clay County, NC. It should be noted that this county is immediately adjacent to Towns County, Georgia. It represents a first for North Carolina because of the political State boundary, but the locations are in the area of the same TVA impoundment (Lake Chatuge) as the Towns County location.

One of the populations has less than a dozen plants and is heavily grazed. The property owner indicated that there were more plants at one time. Observers feel that this site is quite tenuous and may soon disappear. The second site is as large as known populations (0.2 hectare) and while recently cleared, grazed and ditched, seems to be in healthier condition. The newly opened area resulting from bulldozing seems to have stimulated heavier growth. Protection of this site is being sought actively. DES

Stauffer, R.E. 1985 (issued 1987). Cytochemical tests of acid phosphatase secretion by carnivorous plants. Proc. Rochester Acad. Sci. 15:181-185.

Using the substrate Naphthol Phosphate for specific cytochemical staining, and Phenolphthalein Diphosphate as a screening test in test tubes of tissues, the author studied the presence and location of acid phosphatse activity in *Sarracenia purpurea* ssp. *gibbosa* (sic), *S. flava, Utricularia cornuta, U. minor* and *U. vulgaris.* He found intense activity in glands, including nectar attractant glands on the exterior of pitcher plants. There was a faint staining of all other tissues, indicating the wide distribution of the enzyme even though most concentrated in glands. Acid phosphatase activity has been considered as a possible marker for digestive gland activity, but in this editor's opinion, Stauffer's results (internal glands of *S. purpurea* and external glands of nectar attractant type) casts doubt upon digestive specificity. DES

1988 CP SOURCES

Note: All individuals or organizations selling, trading, or buying CP are advised to be cognizant of certain restrictions under the U.S. ESA and international CITES for certain species (see editorial, CPN *123*, 1983).

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Carolina Exotic Gardens Rt. 5, Box 283-A Greenville NC 27834 USA 919/758-2600	$1.00	*Darlingtonia, Dionaea, Drosera, Pinguicula, Sarracenia,* live *Sphagnum* moss
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Hinode-Kadan Nursery 2735 Nakanogo, Hacijyot Hachihyo-Island Tokyo 100-16 JAPAN	International Reply Coupon	*Byblis, Cephalotus, Drosers, Pinguicula, Nepenthes, Utricularia*

See **SOURCES** continued on page 30

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SOURCES continued from page 30

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